THE RED PINE PROJECT

Draft guidelines for red pine management based on ecosystem management principles for State Forestland in Michigan (abridged)

To view the entire Red Pine Project click here (2.9 MB and 69 pages).

Prepared by the Northern Lower Michigan Ecoteam For
The MDNR Statewide Council
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Achieving sustainability in our natural environment, our economy and our communities requires rethinking traditional approaches to managing complex and interrelated natural resources. The fragmented and compartmentalized tactics of the past are giving way to the integrated and comprehensive strategies of ecosystem management. Sustainability of our natural resources through ecosystem-based management is a continuing endeavor by the Michigan Department of Natural Resources. Sustainability assures the well-being of biological communities and their economic vitality by protecting and maintaining the natural environment upon which people and economies depend. The Red Pine Project is a broad-based effort toward implementing the management of the red pine forest type in a long-term sustainable manner for the State Forest system.

Much of Michigan's existing red pine resource was planted on areas devoid of trees, often tax reverted agricultural land, during the 1930s by the Civilian Conservation Corps (CCC), and again in the 1950s by the state of Michigan.

Planting efforts since the 1950s have been at much lower acreages, resulting in an unbalanced age-class structure for this forest type. Despite this extensive planting, red pine as a forest component has declined significantly across northern Michigan since circa 1800. Much of the current red pine resource is in single species plantations and on sites which are sometimes less suitable for red pine than for other species. Despite this, these plantations have nursed the understory reestablishment of deciduous forest communities on richer and moister sites while providing significant economic returns and aesthetic value. Although most of the state's red pine type is of plantation origin, Michigan also has red pine stands that originated naturally as a result of slash fires during the logging era, 80 to 120 years ago. Due to fire suppression, many of these areas are beginning to convert to mesic forest types.

There is a fundamental conflict between increasing red pine timber values and promoting biodiversity. The highest timber values are achieved through pure, densely-stocked uniform age and size stands (plantations). High stocking density fosters height growth and minimizes knots and defects from branching, but it reduces diversity in flora and fauna. This is the basic trade off between timber production and biodiversity values that is faced at several scales, from the stand level through the entire State Forest system.

The range of the natural red pine community (dry northern, dry-mesic, and pine and oak barrens) has been in significant decline since circa 1800. With the confluence of the current red pine type's maturity, its skewed age-class structure, its location on varied habitat types, and its uncertain economic future all needing to be considered, guidelines for the management of red pine as part of a forest community were developed and are presented in this report. These guidelines give resource managers greater flexibility when managing red pine. They enable them to manage red pine in a non-plantation setting on sites ecologically suited for red pine forest communities. Plantation management could still occur in some regions and areas to encourage economic sustainability. The guidelines presented in this report outline a holistic vegetation or forest community-based approach that enables staff to examine the past, present, and potential future context of the resource prior to making stand level decisions. In addition, the guidelines are constructed around the ecological context of red pine and its associated forest and non-forest communities. The economic and social measures that also reflect the mission of the Michigan Department of Natural Resources must be considered as well when making those decisions. To ensure that the guidelines are developed within the context of ecosystem management, a multi-criterion model was used to help set priorities and thus balance biological, social, and economic values.

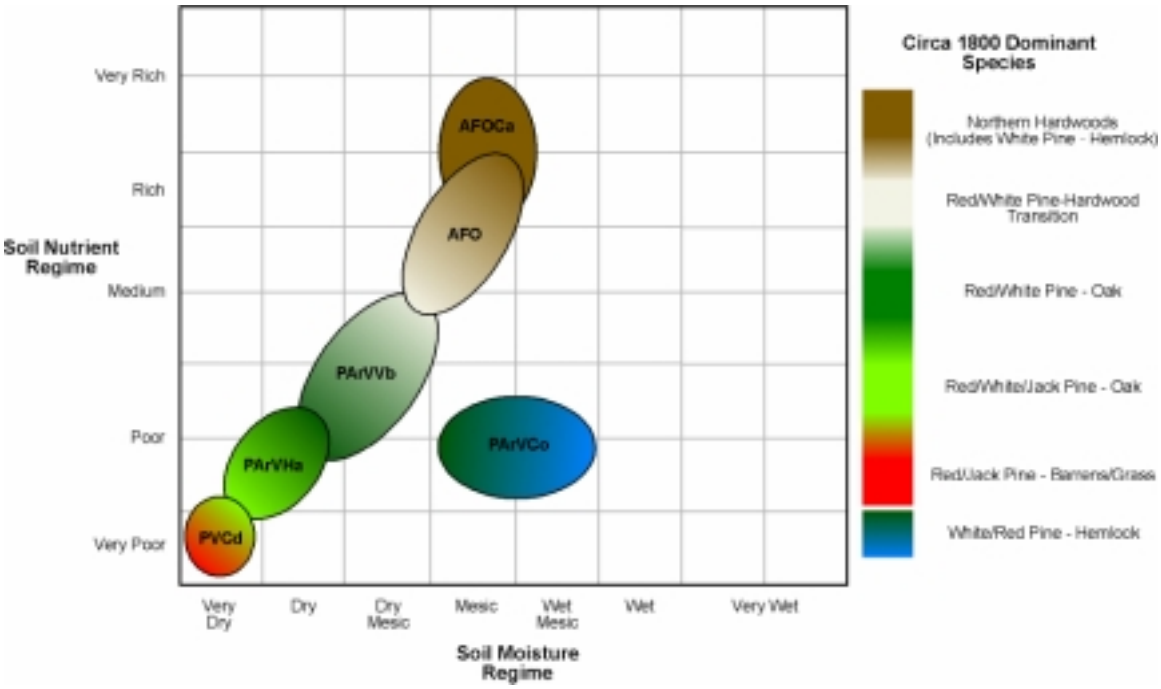
As part of guideline development, a web-based Decision Support System (DSS) has been constructed (http://www.mcgi.state.mi.us/forestHabitatTypes). The DSS, an intuitive system that can be easily used by decision-makers at all levels, provides resource managers with a set of tools that allow them to efficiently assess and implement red pine management at the stand and landscape level using a forest habitat type classification system developed for northern Michigan. With the availability of over half the State Forest compartment maps in digital form, the development of a process at the stand level, up through the Forest Management Unit (FMU) level, and across landscapes, enables the formation of goal-setting and monitoring of management actions. In addition, with the roll out of the Integrated Forest Monitoring and Prescription system (IFMAP), beginning in some areas in 2004 and 2005, the guidelines and tools developed for this project will be made accessible through a desktop computer and the DSS will be used primarily for communication with interest groups and the public.

Initial training and roll out of the red pine guidelines began in August 2003 at the forest habitat type training. Staff were introduced to the red pine guidelines as an example of the use of the forest habitat type system. Formal training and roll out of the guidelines will begin in 2004.

Although several forest communities are mentioned in this report, the red pine project by itself does not address the management of all other forest types. Throughout this report, assessment and discussion generally is limited to State of Michigan lands in the Northern Lower Peninsula (NLP) although

guidelines are also written to accommodate resource managers in the Eastern Upper Michigan (EUP). This is due to the historical and existing high of the red pine resource found within the NLP.

The primary goal of this project is the development of State Forest guidelines for the management of the red pine resource. Prior to the development of these guidelines, the resource was characterized from ecological, economic and social perspectives. This ensures guidelines are developed within an "ecosystem context" that is designed to reflect Wildlife (WL) Division and Forest Mineral and Fire Management (FMFM) Division's missions. A Multi-Objective/Multi-Criteria (MOMC) based Decision Support System (DSS) is presented in the latter part of this paper from which the guidelines can be assessed and implemented at the landscape level. What remains is to integrate these processes at the



Relationship of forest habitat types to soil and circa 1800 forest characteristics in northern Lower Michigan.

operational level and to monitor management actions. Assessment and discussion focuses on State of Michigan lands in the NLP. This is due to the historical and existing high proportion of the red pine found within the NLP, coupled with the associated high percentage of the age-class imbalance in this region. Guidelines are also developed for Eastern Upper Michigan**.**

Utilizing a forest habitat type classification has several advantages. Assessing the potential of a particular site can be accomplished more easily, using only understory plant identification, and often more accurately/consistently than using traditional means such as site index measures. Areas with similar ecological traits can be identified and, therefore, resource managers can make comparisons and assessments about forest community potential using forest habitat types. Forest habitat types provide information about potential tree species occurrence, composition, and successional pathways. Overall the

forest habitat type system is very easy for resource managers to implement and understand, yet provides a wide range of information that can be used to make informed management decisions.

Red Pine Type Guidelines

Fourteen specific guidelines were identified for the management of red pine. Criteria for these guidelines are based on forest habitat type and stand characteristics. Broad silvicultural methods for treatment are also presented in this section. The assertive treatment of the 60 to 80 year old red pine stands and the conversion of other types such as oak to mixed pine stands over the next decade will create another large spike in the zero to nine age class. Although this spike is needed to maintain the red pine resource and to expand its presence across the landscape, it will however, necessitate further redistribution. It will take many years to fully balance the age class structure of red pine, while ensuring the resource is maintained. The economic, biological, forest health, and social aspects of implementing each of the red pine guidelines are summarized in the tables below. The fourteen red pine guidelines are outlined in detail below:

1. Convert Red Pine to Barrens/Grassland

General criteria used to identify suitable stands:

- Red pine present age class 60 – 80
- PVCd - PVCd/PArVHa (also PArVHa adjacent to or within an area of PVCd habitat type). (NLP)
- PVE – PVE/PArV. (EUP)
- Aspen not present in the overstory and or understory.
- Frost Pocket (NLP)
- FR1 fire disturbance history (NLP)

In instances where stands of red pine already occur on the poorest PVCd, PVE, or PArV sites, patch clearcuts of various sizes could be created within the stand. Red pine growing along the periphery of these openings could then be thinned, leaving super-canopy trees, resulting in a park-like setting. Jack pine could be planted at a stocking of 600 – 1,200 trees/acre in some of these openings, or over larger areas, where needed. Adjacent regions or areas within the PVCd type containing the PArVHa habitat type provide a particularly good setting for leaving park-like super-canopy trees and encouraging shrubs. The use of fire and or frost pockets should also be explored as a tool to reduce the future development of woody vegetation. Based on the requirements of grassland species, such as sharp-tailed grouse and prairie chicken, a desired minimum size for a barren should be between 200 and 500 acres. In the EUP, during circa 1800, barrens were typically found on the PVE/PArV forest habitat type, the largest of which was found on Raco Plains, where catastrophic fires periodically occurred. The PVE type is typically found along the Lake Superior shoreline on dune features which, due to their juxtaposition to wetlands, may not have burned as frequently. For additional information on the creation of barrens see the Oak Pine Barren and Pine Barren community abstracts produced by MNFI. There are also opportunities to maintain red

pine in a forested setting both as pure stands and mixed with jack pine, oak, and possibly white pine. Each of these community types historically often occurred on the PVCd, PVE, or PArV habitat type. Jack pine placed on the poorest PVCd sites could provide extended opportunity for Kirtland Warbler management due to its slow growth and poor form on these sites. When managing for Kirtland Warbler, however, consideration could be given to opportunities for the entire barrens community, e.g. large grass openings, savannah, etc.

2. CONVERT RED PINE TO JACK PINE

General criteria used to identify suitable stands:

- Red pine present age class 60 – 80
- PVCd - PVCd/PArVHa. (NLP)
- PVE – PArV. (EUP)
- Aspen not present in the overstory and or understory.

Stands of red pine, that are in the 12 – 18 inch category and occur on the PVCd, PVCd/PArVHa, PVE/PArV, and PArV forest habitat types, can be clearcut and replanted to jack pine. After harvest, the area can be trenched and hand planted to jack pine at a stocking level of about 1,200 trees/acre. Machine planting is an option in lieu of hand planting. Herbicide application is generally not required on these forest habitat types.

3. CONVERT FROM "CLASSIC" RED PINE TO "NATURAL" RED PINE

General criteria used to identify suitable stands:

- Red pine present 60 – 80 years of age.
- The stand is currently a red pine plantation ("classic management").
- Presence of other species in the overstory and or understory such as jack pine, oak and white pine.
- Little or no aspen present in the overstory and or understory.
- PVCd – ParVVb forest habitat types. (NLP)
- PVE - PArVAa forest habitat types. (EUP)

For mature stands of plantation red pine that currently exist on PVCd or PVE, opportunities may exist to change from "classic" to "natural" red pine management. Stands that are approximately 60 - 80 years old, and contain a mixture of other species in the overstory or understory, can be managed to increase these species. Prescribing a shelterwood or seed tree cut and leaving a mixture of trees in the overstory for seed (where possible), will help maintain stand diversity. Scheduling the timber harvest for the snow-free period will enhance soil scarification and create a seedbed better suited for the oak and pine regeneration. Planting red pine and jack pine seedlings, and acorns, could be scheduled as a follow-up if natural regeneration of these species is found to be insufficient. Mechanical scarification and direct seeding can also be considered if conditions warrant. Prescribed burning is also an option for site preparation. A "cool" under-burn can be used before or after a timber harvest to reduce logging slash, a

thick needle buildup, and or hardwood competition. Note that converting from “classic” red pine management to “natural” management will most likely result in less red pine volume in future stands. It is important that a plurality of red pine be re-established so as to maintain this mesic conifer component. On inland dune complexes in the EUP, primarily the PVE habitat type, where fire can be easily controlled, prescribed burning should be used as a means of controlling vegetation and encouraging natural regeneration.

4. CONVERT “OFFSITE” ASPEN TO “NATURAL” RED PINE

General criteria used to identify suitable stands:

- Aspen present older than 40 years of age.
- Poor stocking of aspen (A1, A2, A4, A5, A7)
- Little or no white pine in the understory.
- PVCd - PArVHa forest habitat types. (NLP)
- PVE - PArV/PArV-Ao forest habitat types. (EUP)

Aspen stands, both quaking and big tooth, that occur on the PVCd, PVCd/PArVHa, PArVHa, PVE, PVE/PArV, and PArV habitat types are often of poor quality. In many instances, where a shrub understory such as beaked hazel, witch hazel, and nannyberry, utilized by some wildlife species such as ruffed grouse, is lacking, it may be more desirable to convert these aspen stands to stands containing a mixture of other species with a plurality of red pine. Aspen is eliminated through natural mortality. White pine could be underplanted in some aspen stands where practical (primarily on the PArVHa site). Red pine could be planted in variably stocked aspen stands (in openings and in areas of low stocking and/or declining quality) either in patches or as single trees. As aspen stands further decline in quality, the opportunity to increase the overall percentage of mesic conifers, and especially red pine, will increase. It is important that a plurality of red pine be re-established to maintain this important mesic conifer component. Once the aspen component is virtually eliminated and the red pine reaches a sufficient size, prescribed burning may be an option for stimulating additional reproduction and eliminating deciduous competition. On inland dune complexes in the EUP, primarily the PVE habitat type, where fire can be easily controlled, prescribed burning should be used as a means of controlling vegetation and encouraging natural regeneration.

5. CONVERT “OFFSITE” ASPEN TO “CLASSIC” RED PINE

General criteria used to identify suitable stands:

- Aspen present older than 40 years of age.
- Good aspen stocking density (A3, A6, A8, A9)
- Little or no white pine in the understory.
- PArVHa forest habitat types. (NLP)
- PVE - PArV/PArV-Ao forest habitat types. (EUP)
- Aspen size density:

Aspen stands, with higher stocking densities require clearcutting, an herbicide application, and trenching and planting to establish red pine. Despite an herbicide, application some aspen and other broad leaf trees are likely to survive providing some degree of species mixture.

6. CONVERT OAK TO "NATURAL" RED PINE/OAK MIX (NLP ONLY)

General criteria used to identify suitable stands:

- Oak present at least 50 years of age.
- PVCd - PArVVb forest habitat types.

Oak stands, primarily northern pin oak, white oak, and red oak, occurring on the PVCd, PVCd/PArVHa, and or PArVHa habitat types, are often of questionable quality. Most of these oak stands, in the past, contained mixtures of red, jack and white pine, and oak, most of which were removed by early logging and subsequent slash fires. Much of the oak currently occupying these sites resulted from stump sprouting or seeding while pine is generally absent. In some instances, it will be desirable to convert these relatively pure oak stands to stands containing oak and a variety of conifer species. Oak stands can be converted to mesic conifers by clearcutting and herbiciding, or by relying on natural oak mortality. On the northern pin oak-dominated sites (primarily on the PVCd and PVCd/PArVHa habitat types), red pine could be planted in areas of low stocking and/or declining oak quality, either in patches or as single trees. As these northern pin oak-dominated stands further decline in quality, there will be opportunities to increase the overall percentage of mesic conifers and it is important that a representative amount of red pine be re-established as needed. Northern pin oak, a prolific stump sprouter, can be maintained, where desired, by cutting patches scattered throughout the stands. On the more nutrient and moisture rich PArVHa/PArVVb and PArVVb sites which contain increasing amounts of white and red oak, underplanting white pine has been very successful and that, combined with planting red pine in areas of low stocking and/or openings, can increase the mesic conifer component to a level more appropriate for these habitat types. Prescribed burning may be an option for stimulating additional red pine reproduction and eliminating some oak competition.

7. CONVERT OAK TO "MODIFIED CLASSIC" RED PINE/OAK MIX (NLP ONLY)

General criteria used to identify suitable stands:

- Oak present older than 50 years of age.
- PArVHa - PArVVb forest habitat types.

On forest habitat types higher in quality than PVCd and PVCd/PArVHa where higher survival of red pine is expected, oak stands can be converted to a red pine/oak mixture by clearcutting and using a "modified classic" planting technique. Once the timber harvest is completed the area can be trenched and planted around the oak stumps at a stocking of up to 1,000 trees/acre. Since most oaks produce abundant stump sprouts when cut, oak will be a major component of the new stand, growing along and with the newly planted red pine.

8. SET ASIDE RED PINE FOR BIODIVERSITY (OLD GROWTH POTENTIAL)

General criteria used to identify suitable stands:

- Red pine present older than 80 years of age.
- PVCd - PArVVb (including PArVCo and PArVCo/PArVVb) forest habitat types. (NLP)
- PVE - PArVAa forest habitat types. (EUP)

Although red pine stands older than 80 years are most likely to be of "natural" origin, younger stands may also be the result of natural regeneration (non-plantations) as well. In addition, silvicultural practices within red pine plantations, such as thinning and under planting white pine, can also result in a stand that appears to be the result of natural regeneration. Therefore, areas set aside for biodiversity need not always be older than 80 years of age and in some instances may include former plantations. This is not to say that priority should not be given to stands which already contain high inner-stand diversity and have not been artificially simplified. However, in some regions, the availability of such stands is limited and the conversion of artificially generated stands should be explored. Regardless of origin, fire will likely be needed to improve/maintain both the quality of the stand (ensuring that natural processes are part of the stands management) and to ensure red pine is a component. Under-burning, using a "cool" fire, can be used to reduce hardwood competition as well as to create a seedbed more conducive for pine regeneration. On inland dune complexes in the EUP, primarily the PVE habitat type, where fire can be easily controlled, prescribed burning should be used as a means of controlling vegetation and encouraging natural regeneration.

9. MAINTAIN "CLASSIC" RED PINE

General criteria used to identify suitable stands:

- Red pine present 60 – 80 years of age.
- The stand is currently a red pine plantation ("classic management") (> 79% BA).
- Little or no existing deciduous understory nor overstory (M or A).
- Little or no existing deciduous (O, M or A), hemlock, or white pine, in the understory nor overstory. (EUP)
- PArVHa - AFOCa forest habitat types. (NLP)
- PArV/PArV-Ao – AFOAs forest habitat types. (EUP)

Classic red pine management can be defined as replacing an existing mature stand of red pine, or a mixed stand of pine with a red pine plurality, usually by row planting. This type of management involves clearcutting the stand once it reaches about 16 inches DBH. After the harvest is complete, and depending on the site (most likely on ATFD, AFPo, AFOAs, AFO, AFOCa, PArV, and PArVVb habitat types), herbicide may be necessary to control the herbaceous vegetation and/or encroaching hardwood brush (e.g. cherry, maple, aspen, etc.). Once the herbicide treatment has been completed, the area will be trenched and hand planted to red pine at a stocking of about 1,000 trees per acre. Red pine in association with clumps of hemlock, more common in the EUP particularly on PArV-Ao, should remain undisturbed.

10. CONVERT RED PINE TO WHITE PINE AND OR MIXED WHITE PINE/RED PINE

General criteria used to identify suitable stands:

- Red pine present 60 – 80 years of age.
- White pine present in the understory.
- PArVHa - PArVVb (including PArVCo, PArVCo/PArVVb) forest habitat types. (NLP)
- PVE/PArV - PArVAa/PArV forest habitat types. (EUP)

White pine is well suited for a broad range of forest habitat types. However, its ability to withstand a high water table, which occurs on PArVCo, PArVCo/PArVVb types, makes it a particularly good candidate for these sites where its growth is very rapid. Stands of 60 - 80 year old red pine can be converted to white pine and or a white pine/red pine mixture depending on site conditions. This can be accomplished by prescribing a shelterwood cut that leaves a mixture of both red pine and white pine (if present) in the overstory (at times, white pine trees from adjacent stands can often supply the seed needed to establish white pine in these stands). Because white pine is more shade tolerant and longer lived than red pine, the percentage of white pine in these stands will increase over time. On the wetter PArVCo sites, where there is a relatively stagnant (often adjacent to wetlands) seasonally high water table, converting to white pine is strongly recommended. Scheduling the timber harvest for the snow-free period will increase soil scarification, creating a seedbed better suited for pine regeneration. Planting red pine and white pine can be scheduled as a follow-up if natural regeneration is found to be insufficient. Mechanical scarification and direct seeding could also be considered if conditions warrant. Prescribed burning is also an option for site preparation. A “cool” under burn can be used before or after a timber harvest to reduce logging slash, a thick needle buildup, and or hardwood competition. Note that converting from “classic” red pine management to “natural” management will most likely result in less red pine volume in future stands. On inland dune complexes in the EUP, primarily the PVE habitat type, where fire can be easily controlled, prescribed burning should be used as a means of controlling vegetation and encouraging natural regeneration. Red pine in association with clumps of hemlock, more common on PArVCo and ParV-Ao, should remain undisturbed.

11. CONVERT RED PINE TO NORTHERN HARDWOODS

General criteria used to identify suitable stands:

- Red pine present 60 – 80 years of age.
- Northern hardwood in the understory (M2 and or M3).
- PArVVb - AFOCa forest habitat types. (NLP)
- PArVAa - AFOAs forest habitat types. (EUP)

Stands of 60 - 80 year old red pine on PArVAa and PArVVb habitat types can be converted to red maple and beech-dominated stands, although sugar maple can be present (usually very poor quality), if a well

established understory of northern hardwood seedlings and saplings exists beneath the pine overstory. Likewise, red pine on AFOAs, AFPo, ATFD, AFOCa, and AFO habitat types can be converted to sugar maple-dominated stands if the appropriate understory exists. Depending on the location of these stands, the overstory red pine could be clearcut which would then release the hardwood seedlings and saplings. However, be aware that clearcutting mature red pine stands are often visually disruptive and logging damage to the hardwood seedlings and saplings can be substantial. Such clearcut sites will initially be colonized by pin cherry, blackberry and raspberry and it may take several years before the hardwood regeneration begins to reassume dominance. To minimize the visual impact and to reduce logging damage to the hardwood regeneration, scheduling a modified removal cut, where varying amounts of the overstory red pine are removed, is recommended. Subsequent management could harvest the remainder of the overstory red pine or some of the trees could be left as "veterans", either singly or in groups, scattered among the younger hardwood forest. Red pine in association with clumps of hemlock, more common on the ATFD habitat type in the EUP, should remain undisturbed.

12. CONVERT RED PINE TO ASPEN

General criteria used to identify suitable stands:

- Red pine present 60 – 80 years of age.
- Aspen present (at least 10 sq. of basal area)
- PArVVb - AFOCa, PArVCo forest habitat types. (NLP)
- PArVAa - AFOAs forest habitat types. (EUP)

Stands of 60 - 80 year old red pine that contain scattered aspen (in clones or as single trees) on more productive sites, can be converted to aspen stands relatively easy. These stands should contain at least ten square feet of basal area of aspen that is uniformly spread throughout the stand. Once these stands are clearcut the resulting aspen sprouts will quickly expand and dominate the site. Nothing else will need to be done. Red pine in association with clumps of hemlock, more common on the ATFD, PArVCo habitat type, should remain undisturbed.

13. CONVERT RED PINE TO OAK OR OAK/RED PINE MIXTURES (NLP ONLY)

General criteria used to identify suitable stands:

- Red pine present age class 60 – 80.
- PArVHa - PArVVb forest habitat types.
- Oak regeneration present in the understory (O2 or O3).

Red Pine can be converted to a red pine/oak mixture if a well developed oak sapling understory exists. Depending on the location of these stands, the overstory red pine could be clearcut releasing the oak saplings. Be aware that clearcutting mature red pine is often visually disruptive and logging damage to the oak regeneration can be substantial. Oak, however, is a prolific sprouter and damaged oak saplings will quickly re-sprout and should respond well to being released. To minimize the visual impact and to reduce logging damage to the oak regeneration, scheduling a modified removal cut, where varying

amounts of overstory red pine are removed, is recommended. Future management could harvest the remainder of the overstory red pine or some trees could be left as "veterans," either singly or in groups, scattered among the younger oak forest.

14. CONVERT GRASS OPENINGS TO RED PINE/OTHER MESIC CONIFER MIX

General criteria used to identify suitable stands:

- Upland brush or grass.
- PArVVb - AFOCa forest habitat types. (NLP)
- PArVAa - AFOAs forest habitat types. (EUP)

Existing grasslands (presence of a thick sod layer), as well as previously-cut areas that have not properly regenerated due to heavy elk browsing (this may include M1 or M2 stands that are being browsed down by elk), could be converted to an upland mesic conifer mixture where desired. Red pine, white pine, and white spruce, singly or in combinations, could be hand planted at a stocking of about 400 – 500 trees/acre. Over time such stands would probably develop a hardwood understory that could be managed for hardwood, mesic conifers or a mixture thereof.

GUIDELINE IMPLEMENTATION

Decision Support System (http://www.mcgi.state.mi.us/forestHabitatTypes)/Guideline Use

A web based DSS, constructed using ArcIMS™ software, from which forest habitat types maps were viewed, was modified to allow several data sets, created for and/or used in this project, to be accessed. ArcIMS™ allows the creation of web applications which include interactive maps, allowing the end user to pan, zoom, and identify features derived from GIS data sets.

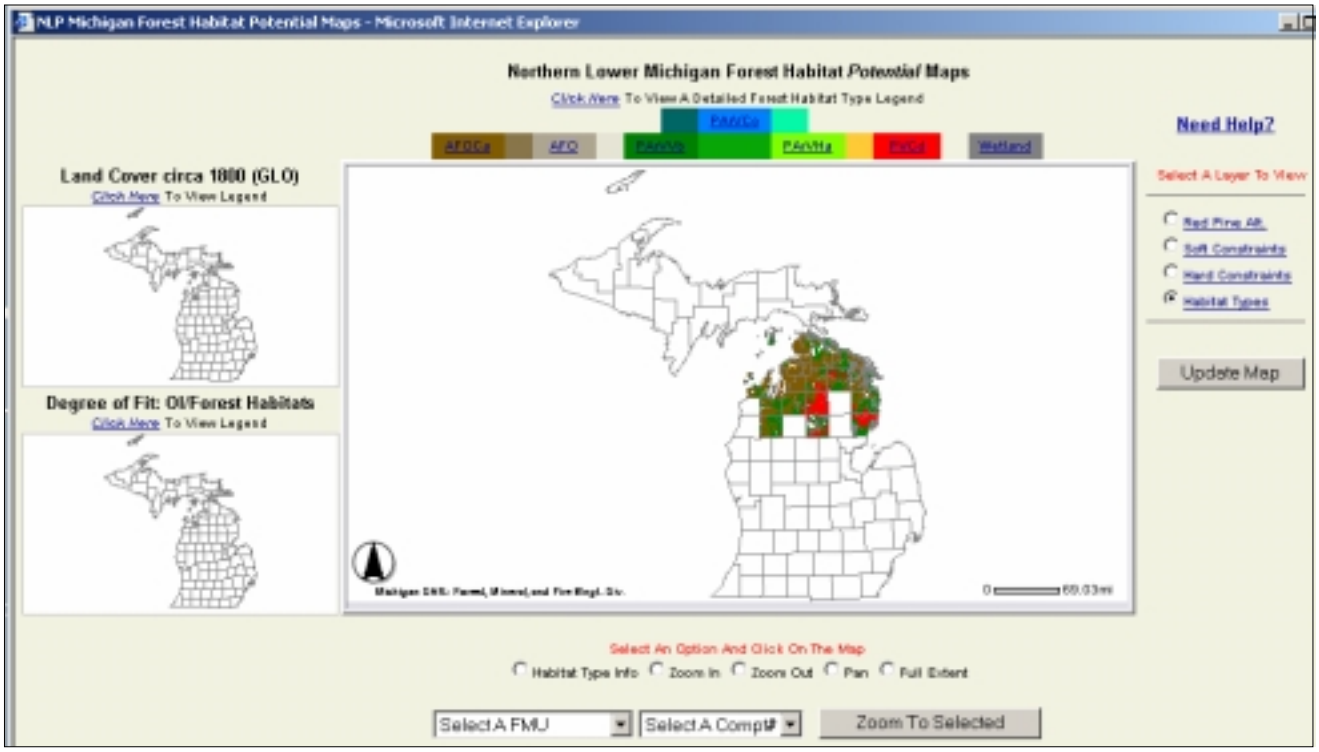
Since the red pine guidelines were developed in concert with the forest habitat, it was decided to incorporate the results of this project into the habitat mapping decision support systems being developed for eastern Upper and northern Lower Michigan. This decision also seemed reasonable because the DSS would allow resource managers to identify forest habitat types and the potential for various future conditions at a particular region and once doing so, have access to guidelines which are based on these types.

In addition, as a window into the future potential of a site, the forest habitat types provide insights into past potential. To provide additional context for the past and future perspectives that the forest habitat types provide, a second and third map frame, displaying the circa 1800 and the relative "suitability" of the current condition (based on OI and the ecological range of various species) was added. Therefore the final DSS is based on the premise that "sound" resource management decisions are often based on an understanding of past, present, and potential future conditions for a region and the result provides this information.

A spatial dimension was added to the red pine guidelines themselves by using the criteria outlined earlier in this report to develop tabular and spatial queries which isolate stands or parts of stands

as being suitable for a particular type of management. This layer, called “Red Pine Alt.” (red pine alternatives), which is accessible from the right side of the application, “…depicts areas suitable for management involving red pine on State Forest lands during the next decade (~2003 – 2012).” The layer also provides a link to the red pine guidelines generated in this report.

Although resource managers will initially have access to the forest habitat types and the red pine alternatives through a web based DSS, these layers and documents will be added to the Integrated Forest Monitoring and Prescription (IFMAP) desktop computer application. This application will give resource managers easy access to the tools and guidelines developed for this project at all levels of the decision making process. Once the IFMAP application is rolled out to DNR staff in 2004 and 2005, the DSS will likely be used primarily to share information with the public and interest groups unable to access the DNR network and the IFMAP system.



Web based decision support system which will house the red pine guidelines and subsequent maps.

Although the layers in the forest habitat type decision support systems will provide a wide range of information that can aid resource managers in decision making, this information is not intended to be a substitute for field work but rather a supplement to it. The information in the DSS does however provide a multi-level perspective that is often difficult to ascertain in the field, at the stand level, and therefore facilitates multi-scale decision making.

With the aid of this report (much of the information discussed below has been already assembled for this report), the DSS and/or the IFMAP application, it is recommended that resource managers use the following four step process, although determining the past and present condition can be done at the

same time, to evaluate community conditions and opportunities before implementing the red pine guidelines on a stand, compartment, or unit level:

- **Current Condition**: Determination of the current forest/non-forest community conditions on State Forest lands at the regional and local levels. Forest and non-forest inventory data, collected during IFMAP stage 1 and 2, and the statewide land cover map within the IFMAP system, will provide a detailed picture of current cover conditions. The MIWILD database provides a means of examining the current condition of wildlife habitats. The existing OI and FIA databases, particularly where data have not been collected as part of the IFMAP system, will also be useful.
- **Past Condition**: After the IFMAP Stage 1 field examination, determine the past community conditions on State Forest land at the regional (FMU, WMU, ecoregional, etc.) and local (compartment) levels. This should include both an examination/assessment of forest/non-forest cover types and wildlife habitat. The red pine report, MIWILD database, and the MNFI circa 1800 cover type map, circa 1800 survey notes, all accessible from the DSS and IFMAP application, may provide the primary sources of information for this assessment (much of this information has already been summarized). Other sources of information include breeding bird surveys, fire disturbance history, archived Operations Inventory (OI) data, and Forest Inventory and Analysis (FIA) data. This assessment, including the recommendations in the red pine report, will influence the selection of areas for IFMAP Stage 2 inventory at the post Stage 1 meeting.
- **Potential Future Condition**: During the IFMAP post Stage 2 meeting, the potential future condition for State Forest lands at the regional and local levels should be evaluated. The forest habitat type maps including soil attributes such as depth to water table, economic returns, risk of forest pest infestation, landscape management units, and management limitations such as the presence of a riparian corridor, archaeological site, and or a social constraint, will provide the primary sources of information for determining a potential future condition. The MIWILD database provides a means of examining the potential for various wildlife habitats. These data will likely have the greatest influence on management decisions made during and after the IFMAP Stage 2 inventory. Once the forest habitat type(s) have been adequately confirmed and the past and current conditions have been determined red pine guidelines can be implemented.
- **Guideline Use/Compartment Review Process**: Once a complete assessment of the past, present, and potential forest/non-forest community condition has been determined in and around an area of interest, a decision can be made on the most appropriate red pine guideline(s) to use. This will likely occur at the post Stage 2 meeting which equates to the pre-compartment review in the current OI process. When discussing the selection of guidelines at the compartment review process, the data gathered on the past, current, and potential future condition of the resource should be presented as justification for the decision making process. Both a regional and local level perspective should be presented, providing a broader context for the decision making process.

	ECONOMIC IMPACTS (Based on Current Timber Values and an 80 Year Period)						
Guide-line#	**Management**	**Min Change/Acre**	**Max Change/Acre**	**Digitized Acres[+]**	**Est. of Total Acres***	**Min Change****	**Max Change*****
1	Convert red pine to Barrens/Grass	$ (2,500)	$ (3,000)	-3718	-7436	$ (9,295,000)	$ (22,308,000)
2	Convert Red Pine to Jack Pine	$ (1,500)	$ (2,000)	-2478	-4956	$ (3,717,000)	$ (9,912,000)
3	Convert from Classic Red Pine to Natural Red Pine	$ (500)	$ (1,000)	4730	9460	$ (2,365,000)	$ (9,460,000)
4	Convert "Offsite" Aspen to Natural Red Pine	$ 500	$ 1,000	+2614	+5228	$ 1,307,000	$ 5,228,000
5	Convert "Offsite" Aspen to Classical Red Pine	$ 1,500	$ 2,000	+4596	+9192	$ 6,894,000	$ 18,384,000
6	Convert Oak to Natural Red Pine/Oak Mix	$ 500	$ 1,000	+8000	+16000	$ 4,000,000	$ 16,000,000
7	Convert Oak to Modified Classic Red Pine/Oak Mix	$ 1,500	$ 2,000	+40000	+80000	$ 60,000,000	$ 160,000,000
8	Set Aside Red Pine for Biodiversity	$ (2,000)	$ (5,000)	12441	24882	$ (24,882,000)	$ (124,410,000)
9	Maintain Classic Red Pine	$ 0	$ 0	12702	25404	$ 0	$ 0
10	Convert Red Pine to White Pine and/or White Pine/Red Pine Mix	$ (1,000)	$ (2,000)	-1416	-2832	$ (1,416,000)	$ (5,664,000)
11	Convert Red Pine to Hardwood ****	$ (6,000)	$ (10,000)	-5541	-11082	$ (33,246,000)	$ (110,820,000)
12	Convert Red Pine to Aspen	$ (1,000)	$ (5,000)	-2660	-5320	$ (2,660,000)	$ (26,600,000)
13	Convert Red Pine to Oak and/or Oak/Red Pine Mix	$ (1,000)	$ (5,000)	-3845	-7690	$ (3,845,000)	$ (38,450,000)
14	Convert Grass/Upland Brush to Red Pine/Other Mesic Conifer Mix	$ 500	$ 1,500	+626	+1252	$ 313,000	$ 1,878,000
			Acre Totals:	+66,051	+132,102		
	Total 60+ Age Red Pine on State Forest Land (NLP, EUP) :				107,732	*(220,507 Total)*	
		Total Net Gain of Red Pine:			+24,370		
	Net Gain Per Year Over 10 Years:			+1218	+2437		

[+]"-" = loss while "+" = addition of red pine based on guideline implementation

*Estimated acres based on the premise that about 50% of the total acres have been digitized; "-" = loss while "+" = addition of red pine based on guideline implementation

**Based on digitized stand acres

***Based on estimated stand acres

****Significant cash flows are not realized for hardwoods until 60 – 80 years and the loss in revenue diminishes over time to nearly equal or greater than red pine at 100+ years.

Economic implications of the red pine guidelines. If the guidelines were implemented, overall the acres of red pine plantations will be decreasing while the number of acres with a red pine component will increase. Initially red pine harvests will yield significant revenues for the state which will offset the longer-term loss which will peak about 80 years from now.

Guide-line#	Biological Impacts	Forest Health Impacts	Social Impacts
1	Potential to restore pine and oak/pine barrens which are listed as state and globally imperiled. 41 plant, insect, and animal species listed as state threatened, endangered, or special concern utilize barrens ecosystems for habitat. 24 of these are found only in barrens ecosystems.	None in grassland areas, possible risk for sphaeropsis where super canopy RP are near other RP/JP.	Aesthetic value of large trees may result in social conflicts when clear cutting in some regions.
2	Potential to restore dry northern forest and oak pine/barrens communities. Will also provide additional opportunities for Kirtland's Warbler management	Possible risk for sphaeropsis where super canopy RP are near other RP/JP in pockets of forest.	Aesthetic value of large trees may result in social conflicts when clear cutting in some regions.
3	Potential to restore dry northern and dry music forest communities. These forest communities provided habitat for 31 state threatened, endangered, or special concern plant, animal, and insect species have as part of their habitat requirements.	Some risk particularly for sphaeropsis if older red pine are left and significant competition deciduous is present.	Conflicts with hunters possible particularly on PArVVb and PArVAa habitat types which often have high potential for game species habitat management.
4	Potential to restore dry northern and dry-mesic forest communities.	Will eliminate stands of aspen at high risk for disease and mortality. Some risk for red pine particularly for sphaeropsis if older red pine are left and where significant competition deciduous is present.	Some conflicts with hunters possible because of the perception that aspen acres are being lost.
5	Loss of some biodiversity by moving toward single species management.	Few, particularly if the red pine are all even aged.	Some conflicts with hunters possible because of the perception that aspen acres are being lost.
6	Will help to restore the red pine (mesic conifer) component to dry northern and dry-mesic forest oak communities.	Few, particularly if the red pine are all even aged.	Some conflicts with hunters possible because of the perception that oak (deciduous) acres are being lost.
7	Will help to restore the red pine (mesic conifer) component to dry northern and dry-mesic forest oak communities.	Few, particularly if the red pine are all even aged.	Some conflicts with hunters possible because of the perception that oak (deciduous) acres are being lost.
8	Potential to restore old growth dry northern and dry-mesic communities which are among the rarest naturally occurring forest communities in the Great Lakes.	Possible risk for sphaeropsis where super canopy RP are near other RP/JP.	There are social pressures to preserve old growth stands. There are also social pressures to harvest some of these stands.
9	Minimal on hardwood sites with little understory development where RP will help to restore deciduous species. Negative impacts may be significant if extensive herbicide is applied.	Some risk particularly for sphaeropsis if older red pine are left and significant competition deciduous is present.	Aesthetic value of large trees may result in social conflicts when clear cutting in some regions.
10	Potential to restore dry northern and dry-mesic forest communities.	Minimal for both RP and WP. WP develops best in partial shade and is not susceptible to sphaeropsis.	Minimal.
11	Potential to restore a hardwood community and in all likelihood increase the amount of biodiversity on the site.	Will eliminate some stands of RP at risk due to stress from competition.	Aesthetic value of large trees may result in social conflicts when clear cutting in some regions.
12	May increase the biodiversity on some sites.	Minimal.	Aesthetic value of large trees may result in social conflicts when clear cutting in some regions.
13	Will help to restore the oak component to dry northern and dry-mesic forest red pine communities. May increase biodiversity on some sites.	Few, particularly if the red pine are all even aged.	Aesthetic value of large trees may result in social conflicts when clear cutting in some regions.
14	Has potential to begin to restore mesic northern forest communities by allowing deciduous species to re-establish themselves.	Trenching is needed to establish RP. White grubs may be present on sites with a heavy sod layer.	Conflicts may arise if openings are being used for berry picking or hunting.

Biological, forest health, and social implications of the red pine guidelines.